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ELEVATOR CAR DOOR DRIVE DEVICE

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[There are no amendments to this patent.]

Abstract

Objective

This invention pertains to a type of elevator car door drive device that opens/closes a car of an elevator that rises/descends in a shaft of a high-rise building. The objective of this invention is to reduce the number of structural members and the weight of the overall device, and to eliminate slippage of the drive belt so as to increase the power efficiency transmission.

Constitution

According to this invention, in opening/closing doors (5), (6) of elevator car (1), primary coil (23) of linear motor (20) is installed on the aforementioned car; reaction rod (25), which also acts as the secondary conductor of linear motor (20), is fitted on the primary coil such that it can slide back and forth in the axial direction; at the two end portions of said reaction rod (25), closed loop transmission rope (10) is set such that the aforementioned door can be opened/closed.

//see orig. p. 1//

Claims

1. A type of elevator car door drive device characterized by the fact that the following parts are in an elevator car door drive device: a primary coil installed on the aforementioned car; a reaction rod, which also acts as the secondary conductor of the linear motor, is fitted on the primary coil such that it can slide back and forth in the axial direction; and a closed loop

transmission rope that is set on the two end portions of the reaction rod and is connected such that the aforementioned door can be opened/closed.

2. The elevator car door drive device described in Claim 1 characterized by the fact that cooling fins are formed on the periphery of the linear motor.

3. The elevator car door drive device described in Claim 1 characterized by the fact that a weight link mechanism helps close the door installed on the car.

Detailed explanation of the invention

[0001]

Industrial application field

This invention pertains to a type of elevator car door drive device for opening/closing the car door of an elevator that rises/descends in a shaft of a high-rise building.

[0002]

Prior art

Figure 6 is a diagram illustrating a conventional elevator car door drive device for opening/closing the car door of an elevator of this type.

[0003]

As shown in Figure 6, on the front side of elevator car (1) that rises/descends in a high-rise building, guide rail (2) and doorsill (3) are set parallel to each other on the upper and lower sides, respectively. Said guide rail (2) and doorsill (3) are set such that doors (5), (6), each of which has guide rollers (4a) and (4b), can be opened/closed. Also, on said car (1) above said guide rail (2), master shaft (8) equipped with principal pulley (7) is rotated in a freely rotatable manner. On car (1) opposite said master shaft (8), slave shaft (9) is rotated. In addition, said master shaft (8) and said slave shaft (9) are connected to each other by closed loop transmission rope (10) that is wound on them. On one side of the upper portion of opening/closing door (5), long connecting member (11) is erected. The upper portion of said long connecting member (11) is connected to upper rope (10a) of said closed loop transmission rope (10). On the other side of the upper portion of opening/closing door (6), short connecting member (12) is erected. The upper portion of said short connecting member (12) is connected to lower rope (10b) of said closed loop transmission rope (10). Also, on the ceiling of said car (1), drive motor (13) is installed. Output shaft (14) of said drive motor (13) is connected to said principal pulley (7) by means of drive belt (15).

[0004]

Consequently, in the aforementioned elevator car door drive device, when said doors (5), (6) are to be opened, said drive motor (13) is turned ON based on a signal from a controller (not shown in the figure) as said car (1) reaches the desired floor. Output shaft (14) of said drive motor (13) rotates principal pulley (7) with drive belt (15). As a result, master shaft (8) that is integrated to the principal pulley is rotated in the direction indicated by the arrow. Consequently, said closed loop transmission rope (10) wound on said master shaft (8) is driven to move, and, as a result, said doors (5), (6) are opened along guide rail (2) and doorsill (3) via connecting members (11), (12) connected to said closed loop transmission rope (10).

[0005]

On the other hand, for the aforementioned elevator car door drive device, when said doors (5), (6) are to be closed, said drive motor (13) reverses rotation on the basis of the signal from the controller, and said doors (5), (6) are closed along guide rail (2) and doorsill (3).

[0006]

Problems to be solved by the invention

However, in the aforementioned elevator car door drive device, when it has been used for a long time, drive belt (15) slacks, and principal pulley (7) slips. As a result, the power transmission efficiency decreases. In addition, it becomes hard to correctly open/close said doors (5), (6). Besides, maintenance is needed to have a prescribed tension for drive belt (15). Also, because drive motor (13) is installed above said car (1), the overall device becomes larger, and problems may occur with respect to the balance of the car itself.

[0007]

The objective of this invention is to solve the aforementioned problems of the conventional methods by providing a type of elevator car door drive device characterized by the fact that it can reduce the number of structural members, simplify the assembly adjustment, decrease the overall weight of the device, and, at the same time, eliminate slippage due to slack of the drive belt so as to increase the power transmission efficiency.

[0008]

Means to solve the problems

According to this invention, on the opening/closing doors of an elevator car, a primary coil of a linear motor is installed; a reaction rod that also acts as the secondary conductor of the linear motor is installed on the primary coil such that it can slide back and forth in the axial

direction; and, on the two end portions of the reaction rod, an closed loop transmission rope is set and connected such that said doors can be opened/closed.

[0009]

Functions

According to this invention, when the aforementioned car reaches the desired floor and the aforementioned doors are to be opened, the linear motor is turned on based on a signal from a controller. While the aforementioned closed loop transmission rope connected to the reaction rod that also acts as the secondary conductor of the linear motor is driven to move, the door on one side is opened by means of the long connecting member. At the same time, the door on the other side is also opened via the short connecting member connected to the aforementioned closed loop transmission rope. On the other hand, when said doors are to be closed, the aforementioned linear motor reverses its rotation based on a signal from the controller, and the aforementioned doors are driven to close along the guide rail and doorsill based on the signal from the controller. As a result, it is possible to reduce the number of structural members, to simplify the assembly adjustment, and to decrease the weight of the overall device. Also, it is possible to prevent slippage due to slack of the drive belt, so that it is possible to increase the power transmission efficiency.

[0010]

Application examples

In the following, let's look at an application example of this invention. In this application example, the same part numbers as those described above are adopted.

[0011]

In Figures 1-3, (1) represents an elevator car that rises/descends in a shaft in a high-rise building. On the front side of elevator car (1), guide rail (2) and doorsill (3) are set parallel to each other on the upper and lower sides, respectively. Said guide rail (2) and doorsill (3) are set such that doors (5), (6), each of which has guide rollers (4a) and (4b), can be opened/closed. Also, on said car (1) above said guide rail (2), master shaft (8) is pivoted in a freely rotatable manner. On car (1) opposite said master shaft (8), slave shaft (9) is driven. In addition, said master shaft (8) and said slave shaft (9) are connected to each other by closed loop transmission rope (10) that is wound on them. In the upper portion of opening/closing door (5), long connecting member (11) is erected. The upper portion of said long connecting member (11) is connected to upper rope (10a) of said closed loop transmission rope (10). In the upper portion of opening/closing door (6) on the other side, short connecting member (12) is erected. The upper

portion of said short connecting member (12) is connected to lower rope (10b) of said closed loop transmission rope (10).

[0012]

On the other hand, as can be seen from the enlarged view in Figure 2, linear motor (20) is installed horizontally on said car (1) where upper rope (10a) is positioned. For said linear motor (20), plural box-shaped cores (22) are set as a ring on case main body (21). In each box-shaped core (22), primary coil (23) made of a ring coil is set. A pair of bearings (24) are attached to the two end portions of said case main body (21). On said two bearings (24), reaction rod (25) that also acts as the secondary conductor of linear motor (20) is fit such that it can slide back and forth in the axial direction. One end portion of said reaction rod (25) is connected to upper rope (10a) on the upper portion of said long connecting member (11), and the other end portion of said reaction rod (25) is connected to upper rope (10a) of said closed loop transmission rope (10). That is, the two end portions of said reaction rod (25) are connected to the two end portions of said closed loop transmission rope (10).

[0013]

Consequently, when power is turned on to said linear motor (20), said reaction rod (25) that also acts as the secondary conductor slides in the axial direction, and said closed loop transmission rope (10) moves to the left or to the right.

[0014]

On the other hand, as shown in Figure 1, on said car (1) above said reaction rod (25), close position detection sensor (26a) is attached such that it can detect the closing position of said opening/closing door (6). On opposite side of said close position detecting sensor (26a) on said car (1), open position detection sensor (26b) is attached such that it can detect the open position of said opening/closing door (6). In addition, on said car (1), controller (27), such as a low-speed drive controller, is connected such that it controls the power fed to said linear motor (20). Said controller (27) usually contains a frequency-variable inverter, and this controller (27) can perform variable drive control for said linear motor (20). Also, said controller (27) is connected via lead lines to said close position detection sensor (26a) and open position detection sensor (26b). Based on the signal from an operation panel (not shown in the figure), said controller (27) can control said reaction rod (25) of said linear motor (20) to slide to the left or to the right.

[0015]

In the following, the function of this invention will be explained.

[0016]

When said car (1) reaches the desired floor and said doors (5), (6) are to be opened, said linear motor (20) is turned ON based on a signal from said controller (27). Then, reaction rod (25) that also acts as the aforementioned secondary conductor of linear motor (20) slides to the left, and said closed loop transmission rope (10) connected to it is driven to move. At the same time, opening/closing door (5) is opened on one side along guide rail (2) and doorsill (3) by means of long connecting member (11), while said other opening/closing door (6) is opened along guide rail (2) and doorsill (3) via short connecting member (12) connected to said closed loop transmission rope (10). At the same time, said open position detection sensor (26b) detects the other end portion of said reaction rod (25) and sends the detection signal to said controller (27). Then, said linear motor (20) is stopped on the basis of a signal from controller (27).

[0017]

On the other hand, when said doors (5), (6) are to be closed, said linear motor (20) reverses rotation on the basis of a signal from said controller (27), so that said doors (5), (6) are closed along guide rail (2) and doorsill (3), and, at the same time, said close position detection sensor (26a) detects one end portion of said reaction rod (25), and sends the detection signal to said controller (27). Then, said linear motor (20) is stopped on the basis of a signal from controller (27).

[0018]

In this way, according to this invention, doors can be opened/closed at a high speed. Also, it is possible to reduce the number of structural members, to simplify the assembly adjustment, and, at the same time, to reduce the weight of the overall system and to prevent slippage due to slack of the drive belt. As a result, the transmission efficiency can be increased.

[0019]

In the following, let's look at another application example of this invention illustrated in Figure 4. In this application example, cooling fins (29) are formed in a radial shape on the outer periphery of case main body (21) and box-shaped cores (22) of said linear motor (20). As a result, the heat of said linear motor (20) can be dissipated at a high efficiency.

[0020]

Consequently, said cooling fins (29) can effectively increase the feed supply rate of said linear motor (20), ensure high-speed movement and increase the holding power.

[0021]

On the other hand, in another application example shown in Figure 5, weight link mechanism (28) composed of weight link (28a) and rocking link (28b) is attached to door (6) of car (1) to improve the closing of the door.

[0022]

After said doors (5), (6) are opened, said weight link mechanism (28) ensures that car (1) will not close as it rises/descends in the shaft. In case of a power outage for said linear motor (2), the mechanism helps to keep said doors (5), (6) closed.

[0023]

Effects of the invention

As explained above, according to this invention, a primary coil is installed on the aforementioned car; a reaction rod that also acts as the secondary conductor of the primary coil is fitted on the primary coil such that it can slide back and forth in the axial direction; on the two end portions of the reaction rod, a closed loop transmission rope is set and connected such that it can open/close said doors. Consequently, it can reduce the dimensions of the car, reduce the number of structural members, simplify assembly adjustment, enable high-speed opening/closing of the doors, reduce the weight of the overall device, and, at the same time, prevent slippage due to slack of the drive belt so as to increase the power transmission efficiency. These are the excellent benefits of this invention.

Brief description of the figures

Figure 1 is a front view of the elevator car door drive device of this invention.

Figure 2 is an enlarged cross-sectional view illustrating the main portion of the elevator car door drive device of this invention.

Figure 3 is an exploded oblique view of the main portion of the elevator car door drive device of this invention.

Figure 4 is a diagram illustrating another application example of this invention.

Figure 5 is a diagram illustrating yet another application example of this invention.

Figure 6 is a front view of a conventional elevator car door drive device that has been proposed.

Brief description of part numbers

1	Car
5, 6	Opening/closing door
10	Closed loop transmission rope
11	Long connecting member
12	Short connecting member
20	Linear motor
23	Primary coil
25	Reaction rod
26a	Close position detection sensor
26b	Open position detection sensor
27	Controller

//insert//

Figure 1

//insert//

Figure 2

//insert//

Figure 3

//insert//

Figure 4

//insert//

Figure 5

//insert//

Figure 6